flocculated mass; and using the recovered flocculated mass as a nutrient source or animal feed.

34. (amended) A process to remove phosphorus from an aqueous stream, which comprises phosphorus, consisting essentially of adding one or more metal ions selected from the group consisting of titanium and zirconium, and a cationic organic polymer to the stream to produce a flocculated mass wherein the metal ion and said organic polymer is each present in the range of from about 1 to about 2,500 ppm, based on weight of the stream.

REMARKS

Claim 32 was objected to and is amended to depend from claim 28, as originally recited. The objection is therefore submitted to be now moot because the oversight is corrected by the amendment.

Claims 1, 5, 15, 25, and 34 are amended to recite the concentration of metal ion(s), organic polymer (claims 1, 15, and 25), and cationic organic polymer (claim 34). The metal ion concentration is disclosed in the specification on page 7, lines 11-14 and on page 9, lines 7-16. The recitation of cationic organic polymer is originally recited in claim 5.

Claims 1, 3-5, 7-14, 23, and 24 were rejected under 35 USC 103(a) over Allgulin in view of Chung et al. The rejection was traversed in applicant's response to the first Office Action on the grounds that Chung et al is not a relevant art to the claimed invention. However, the examiner has not responded to whether Chung et al is a non-analogous art. Instead, the examiner merely reiterates the rejection.

The examiner required applicant to substantially narrow the scope of the claims based on the Moffett Declaration submitted with the response to the first Office Action. However, the Declaration was submitted to show that elements (c) and (d) recited in the claims are required to produce a flocculated mass. The Moffett Declaration specifically demonstrates that before addition of elements (c) and (d), there is little or no reduction in phosphorus and COD content. The examiner has not shown a reference suggesting such requirement.

The Moffett Declaration was not submitted to show the limit of, and should not be interpreted as to unduly limit, the scope of the invention.

The question is whether the references relied on by the examiner suggest the requirement of both elements (c) and (d).

The examiner answered the question by directing applicant to Allgulin at column 4, lines 59-63 where it discloses that, *upon the completion of the precipitation process*, the solution and the precipitate present therein is passed through a pipe 18 to a flocculating tank 20, to which a suitable flocculating agent is passed through a supply pipe 19. In the same column, it also discloses, in lines 51-53, that any mercury and other heavy metals present in the solution will thus be *precipitated out, together with any arsenic and phosphorous* [sic] and the iron, to leave extremely low residual contents (italics applicant's).

Allgulin clearly discloses that *any* phosphorus is precipitated at tank 17. There is no more phosphorus to be precipitated in tank 20. As such, Allgulin does not suggest a flocculating agent is added to precipitate phosphorus. Instead, the flocculant is added to aid in removal of the precipitate in the lamella, not to precipitate phosphorus. See, e.g., column 4, line 64 to column 7, line 5.

As discussed above, the claimed invention requires both an organic or a cationic organic polymer and a silica-based inorganic anionic colloid or an anionic organic polymer to be effective. Allgulin fails to so suggest while Chung et al does not deal with phosphorus removal.

Applicant wishes to stress that the claimed invention requires the addition of both an organic polymer and a silica based inorganic anionic colloid or an anionic organic polymer as recited in the claims to precipitate phosphorous and to produce a flocculated mass. Without addition of both an organic polymer and a silica-based inorganic anionic colloid or an anionic organic polymer as previously responded to the first Office Action, there is little or no reduction in phosphorus and COD content. This was demonstrated in the Moffett Declaration. The fact that the addition of a silica-based inorganic anionic colloid or an anionic organic polymer causes unexpected precipitation, not simple flocculation, of the phosphorous is demonstrated in Example 5. This example shows that even when all elements of the invention, with the exception of the silica-based inorganic anionic colloid or an anionic organic polymer, are added, a significant portion of the phosphorous is able to pass through a 1.5 μ filter, particularly when lesser amounts of zinc are used. Applicant sees no

such synergistic effect for phosphorous precipitation suggested in the references. It is quite unexpected for an anionic polymer or colloid to cause precipitation of soluble anionic phosphates.

Claims 2-4, 6-14, and 25-33 were rejected under 35 USC 103(a) over Allgulin in view of Chung et al and further in view of Laurent et al.

Again, the examiner has not responded to applicant's response that Chung et al is a nonanalogous art. As discussed above, Allgulin and Chung et al do not suggest that both elements (c) and (d) recited in the claims are required to produce a flocculated mass.

Laurent et al does not cure the lack of suggestion in the combined Allgulin and Chung et al because it does not suggest the teaching missing in Allgulin and Chung et al; i.e., the need to add both an organic polymer and either a silica-based inorganic colloid or an anionic polymer. Whether Laurent et al discloses the use of recovered waste is immaterial to the claimed invention.

Claims 15-16, 19, 22-24, and 34 were rejected under 35 USC 103(a) over Ayukawa in view of Monick et al.

Applicant responded to the first Office Action suggesting that no reasonable person would, in view of Ayukawa disclosure, combine Zr metal ions and inorganic colloids together because the *facts* disclosed in Ayukawa show that colloidal dispersed particles are *coagulated and precipitated* by an aqueous solution of $ZrOCl_2 \cdot 8H_2O$. The facts are disclosed in Ayukawa, not applicant's allegation as asserted by the examiner.

The facts disclosed in Ayukawa are that addition of Zr metal ions precipitates colloidal material and, consequently, cannot "re-precipitate" phosphorus. A "precipitate", by definition, is sunk to the bottom and cannot raise itself to the middle or surface of a stream to react with, and precipitate, soluble phosphorus.

If Ayukawa disclosure were correct, an anionic inorganic colloid recited in the claimed invention would or should be precipitated by the cationic Zr or Ti metal ions (because Ayukawa discloses precipitating colloids with metal ions). Once precipitated, applicant sees no mechanism for the "inorganic colloid-Zr (or Ti) precipitate" to act in the aqueous stream to "precipitate" any phosphorus in the

stream. Ayukawa disclosure therefore leads one skilled in the art away from the claimed invention which requires the addition of the metal ions and the colloids.

To the contrary, the present application shows that, without the addition of Ti (Table 9; page 20) or Zr (Table 10; page 21) ions, addition of anionic colloid (SiO_2) and cationic polyacrylamide (flocculant) reduced little (Table 10) or less than 50% (Table 9) of phosphorus present in the wastewater. Additionally, the Moffett Declaration also shows merely adjusting pH with an acid followed by addition of Ti or Zr did not appreciably reduce the P concentration.

The examiner then stated that Monick et al is used to teach that it is known to add zirconium ... to an aqueous stream ... and applicant has not presented sufficient factual evidence.

To rebut the examiner's statement, applicant submits that the factual evidence, as discussed above, is in the Ayukawa disclosure.

Regarding the Monick et al disclosure, Monick et al discloses a treatment composition using, among others, a *catalyst comprising zirconium* (italic applicant's). See, e.g., column 2, lines 16-22. Monick et al does not disclose or suggest addition of zirconium compound as a precipitating agent, as the examiner incorrectly asserted.

A catalyst is known to one skilled in the art as a substance that by its mere presence alters the velocity of a reaction and it itself may be recovered unaltered and in the same amount at the end of the reaction. The factual evidence can be found in many textbooks. For example, Hackh's Chemical Dictionary defines a catalyst as a substance which changes the speed of a chemical reaction, but is present in its original concentration at the end of the reaction. The Monick et al composition comprising zirconium as catalyst indicates that zirconium is not a reactant. That is, Monick et al does not suggest zirconium as precipitant or flocculant.

In fact, Monick et al suggests that the zirconium acts as a pH controller (Column 5 lines 20-21).

Furthermore, Monick et al composition comprises alkali or alkaline carbonate (abstract) at 1 to 10 % (preferably 3 to 4 %, column 4, lines 25-27), i.e., a lot of alkali. Such disclosure does not provide suggestion for reducing the pH of a stream to less

than 7 as recited in claims 16, 19, and 22. In fact, the Monick et al disclosure leads one skilled in the art away from the claimed invention.

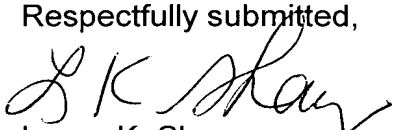
It is not known whether phosphorus can be precipitated at a high pH. Monick et al discloses addition of a lot of alkali that would certainly raise the pH. Applicant requests that the examiner investigate whether phosphorus precipitates at high pH.

Claims 17-18, 20-22, and 35-40 were rejected under 35 USC 103(a) over Ayukawa in view of Monick et al and further in view of Laurent et al.

First, claims 17-18, 20-22, and 35-40 require the adjustment of pH to 7 or lower. To the contrary, as discussed above, Monick et al composition comprises alkali or alkaline carbonate. Monick et al disclosure does not provide suggestion for reducing the pH of a stream to less than 7 as recited in thee claims 16, 19, and 22. Monick et al disclosure leads one skilled in the art away from the claimed invention.

Even if Monick et al can be argued as suggesting reducing pH to 7 or lower (in fact, it does not), the question is whether Laurent et al cures the deficiency of Ayukawa in view of Monick et al. The deficiency is the suggestion for combining both metal ions and an organic polymer following a sequential pH adjustments. Whether Laurent et al discloses the use of recovered waste is immaterial to the claimed invention because Laurent et al does not cure the deficiency.

Respectfully submitted,



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APPENDIX

1. (amended) A process to remove phosphorus from an aqueous stream, which comprises phosphorus, comprising: (a) adjusting pH of the stream to a pH of at least 7 by adding a calcium-containing compound; (b) adding one or more metal ions selected from the group consisting of zinc and manganese ions to the stream wherein the metal ion is present in the range of from about 0.01 to about 10,000 ppm, based on weight of the stream; (c) adding ~~an~~ a silica-based anionic inorganic colloid to the stream; and (d) adding ~~a flocculant~~ an organic polymer at about 0.01 to about 10,000 ppm, based on weight of the stream, to produce a flocculated mass.

5. (amended) A process to remove phosphorus from an aqueous stream, which comprises phosphorus, comprising (a) adjusting pH of the stream to a pH of at least 7 by adding a calcium containing compound; (b) adding one or more metal ions selected from the group consisting of zinc ions and manganese ions to the stream wherein the metal ion is present in the range of from about 0.01 to about 10,000 ppm, based on weight of the stream; (c) adding at least one cationic organic polymer to the stream; and (d) adding at least one anionic organic polymer to the stream to produce a flocculated mass.

15. (amended) A process to remove phosphorus from an aqueous stream, which comprises phosphorus, comprising (a) adding one or more metal ions selected from the group consisting of titanium and zirconium to the stream; and (b) adding ~~a flocculant~~ an organic polymer at about 0.01 to about 10,000 ppm, based on weight of the stream, to the stream to produce a flocculated mass.

25. (amended) A process consisting essentially of adjusting the pH of an aqueous stream, which comprises phosphorus, to at least 7 by adding a calcium-containing compound; adding one or more metal ions selected from the group consisting of zinc ions, manganese ions, and mixtures thereof to the stream wherein the metal ion is present in the range of from about 0.01 to about 10,000 ppm, based on weight of the stream; ~~and~~

(a) adding an anionic inorganic colloid and ~~a flocculant~~ an organic polymer at about 0.01 to about 10,000 ppm, based on weight of the stream to produce a flocculated mass; or

(b) adding at least one cationic organic polymer and at least one anionic organic polymer to the stream to produce a flocculated mass; or

(c) adding ~~a flocculant~~ an organic polymer at about 0.01 to about 10,000 ppm, based on weight of the stream, to produce a flocculated mass; and recovering the flocculated mass; and using the recovered ~~the~~ flocculated mass as a nutrient source.

32. (twice amended) The process of claim 28 wherein said process consists essentially of adjusting the pH of an aqueous stream, which comprises phosphorus, to at least 7 by adding a calcium-containing compound; adding one or more metal ions selected from the group consisting of zinc ions, manganese ions, and mixtures thereof to the stream; adding ~~an anionic inorganic colloid to the stream; adding~~ a ~~flocculant~~ silica-based anionic inorganic colloid; adding a cationic organic polymer to the stream to produce a flocculated mass; recovering the flocculated mass; and using the recovered ~~the~~ flocculated mass as a nutrient source or animal feed.

34. (amended) A process to remove phosphorus from an aqueous stream, which comprises phosphorus, consisting essentially of adding one or more metal ions selected from the group consisting of titanium and zirconium, and a ~~flocculant~~ cationic organic polymer to the stream to produce a flocculated mass wherein the metal ion and said organic polymer is each present in the range of from about 1 to about 2,500 ppm, based on weight of the stream.